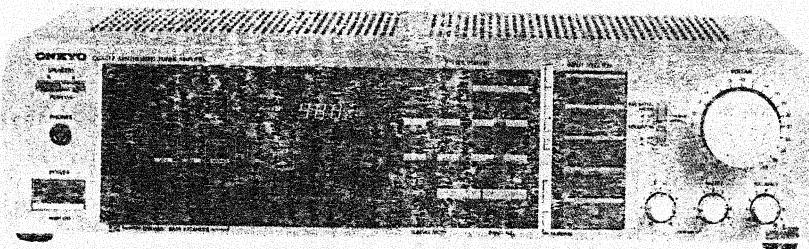


# ONKYO SERVICE MANUAL

## QUARTZ SYNTHESIZED TUNER AMPLIFIER MODEL TX-7230



Silver and black models

### SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK  $\Delta$  ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PARTS NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

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**ONKYO**  
**AUDIO COMPONENTS**

# SPECIFICATIONS

## AMPLIFIER SECTION

|                            |  |
|----------------------------|--|
| Power Output:              | 40 watts per channel, min RMS, at 8 ohms, both channels driven, from 20Hz to 20kHz, with no more than 0.04% THD. |
| Musical Power Output:      | 2 x 85 watts at 4 ohms, 1kHz (DIN)   |
| Continuous Power Output:   | 2 x 55 watts at 8 ohms, 1kHz (DIN)   |
|                            | 2 x 55 watts at 4 ohms, 1kHz (DIN)   |
| Total Harmonic Distortion: | 2 x 40 atwatts ato at 8 ohms, 1kHz (DIN)   |
| 0.08% at rated power       |  |
| 0.08% at 1 watt output     |  |
| IM Distortion:             | 0.08% at rated power   |
|                            | 0.08% at 1 watt output   |
| Damping Factor:            | 35 at 8 ohms   |
| Frequency Response:        | 20 – 30,000 Hz ± 1 dB  |
| RIAA Deviation:            | 20 – 20,000 Hz ± 0.8dB   |
| Sensitivity and Impedance: | Phono: 2.5mV/50 kohms<br>CD/Tape Play: 150mV/50 kohms<br>Tape Rec: 150mV/3.5 kohms (phono)                       |
| Phono Overload:            | 180mV RMS at 1 kHz, 0.04% THD  |
| Signal-to-Noise Ratio:     | Phono: 85dB (at 10mV input, A weighted)<br>76dB (IHF A-202)  |
|                            | CD/Tape: 95dB (A weighted)<br>80dB (IHF A-202)   |
| Tone Controls:             | Bass: ± 10dB at 100Hz<br>Treble: ± 10dB at 10kHz   |
| Loudness (-30dB):          | +7 dB at 70 Hz, +5 dB at 10kHz   |
| Subsonic:                  | -6 dB at 15 Hz   |

## TUNER SECTION

### FM:

|                            |  |
|----------------------------|--|
| Tuning Range:              | 87.5 – 108.0 MHz (50kHz steps)   |
| Usable Sensitivity:        | Mono: 12.8dBf, 1.2μV, 75 ohms<br>1.0μV (S/N 26dB, 40kHz Devi.)<br>75 ohms DIN  |
|                            | Stereo: 18.0dBf, 2.2μV, 75 ohms<br>23μV (S/N 46dB, 40kHz Devi.)<br>75 ohms DIN |
| 50dB Quieting Sensitivity: | Mono: 18.0dBf, 2.2μV 75 ohms<br>Stereo: 37.2dBf, 20μV, 75 ohms                 |
| Capture Ratio:             | 1.5dB  |
| Image Rejection Ratio:     | 85dB   |
| IF Rejection Ratio:        | 90dB   |
| Signal-to-Noise Ratio:     | Mono: 71dB<br>Stereo: 66dB   |
| Selectivity:               | 50dB DIN (±300kHz, 40kHz dev.)   |
| AM Suppression Ratio:      | 50dB   |
| Harmonic Distortion:       | Mono: 0.15%<br>Stereo: 0.3%  |
| Frequency Response:        | 30 – 15,000Hz ± 1.5dB  |
| Stereo Separation:         | 40dB at 1kHz<br>30dB at 100 – 10,000Hz   |
| Tuning Level(Hi/Lo):       | –  |
| Muting Level:              | 17.2dBf, 2μV   |
| Stereo Threshold:          | 17.2dBf, 2μV   |
| <b>AM:</b>                 |  |
| Tuning Range:              | 522 – 1611kHz (9kHz steps)   |
| Usable Sensitivity:        | 30μV   |
| Image Rejection Ratio:     | 40dB   |
| IF Rejection Ratio:        | 40dB   |
| Signal-to-Noise Ratio:     | 40dB   |
| Harmonic Distortion:       | 0.8%   |

## GENERAL

|                     |  |
|---------------------|--|
| Semiconductors:     | FETs: 7 TR: 37 ICs: 10   |
| Dimensions (WxHxD): | Diodes: 54 LEDs: 28<br>435 x 112 x 343 mm<br>17-1/8" x 4-7/16" x 13-1/2" |
| Weight:             | 7.8 kg 17.2 lbs.   |

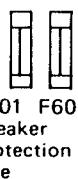
Specifications and features are subject to change without notice.

## **SERVICE PROCEDURES**

## 1. Replacing the fuses

For continued protection against fire hazard, replace only with same type and same rating fuse.

| Circuit no. | Parts no. | Description           |
|-------------|-----------|-----------------------|
| F501, F601  | 252076    | 3.15A-SE-EAK, Primary |
| F902        | 252074    | 2A-SE-EAK, Primary    |
| F903, F904  | 252078    | 5A-SE-EAK, Secondary  |
| F905        | 252070    | 1A-SE-EAK, Secondary  |



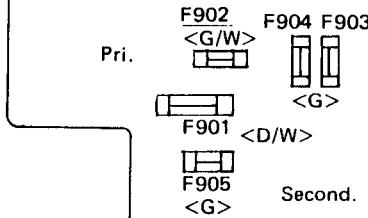
## 2. Replacing the lamp

This unit uses the lamp listed below.

Circuit no. Parts no. Description  
 PL901 210064A PL 6.3V, 250mA, Dial  
 plate illumination

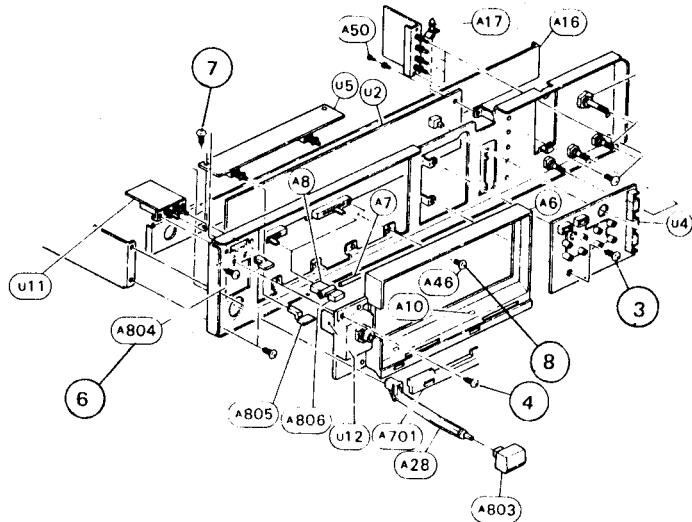
### **3. Removal of display pc board**

- ①. Remove the five screws holding the top cover and chassis (side bracket:4 back panel: 1), and remove the top cover.
- ②. Remove the five screws holding the front panel and front bracket, and remove the front panel.
- ③. Remove the two screws holding the switch pc board and front bracket, and remove the switch pc board of U4.
- ④. Remove the four screws holding the holder and front bracket.
- ⑤. Remove the display pc board ass'y from the four nails of holder, and remove the holder.
- ⑥. Remove the two knobs (A805).
- ⑦. Remove the two screws holing the NAAF-2306 pc Board ass'y and center bracket, and remove the NAAF-2306.
- ⑧. Remove the two screws holding the switch of dynamic bass expander and front bracket, and remove the display pc board.



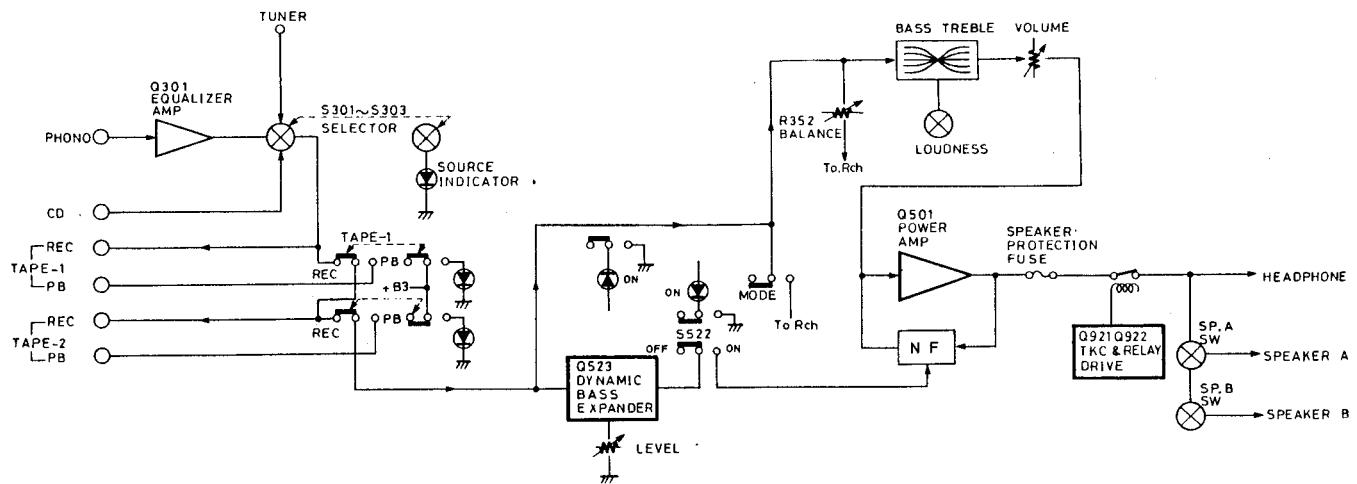
#### 4. Memory Preservation

This unit does not require memory preservation batteries. A built-in memory power back-up system preserves contents of the memory during power failures and even when the unit is unplugged. The unit must be plugged in and the power switch turned on and off once in order to charge the back-up system. Note that since this is not a permanent memory, the power switch must be turned on and off a few times each month to keep the back-up system operable. The period of time during which memory contents are preserved after power has last been turned off varies depending on climate and the location and placement of the unit. On the average, memory contents are protected over a period of 3 to 4 weeks (a minimum of 2 weeks) after the last time power has been turned off. This period is shorter when the unit is exposed to very high humidity or used in an area with an extremely humid climate.

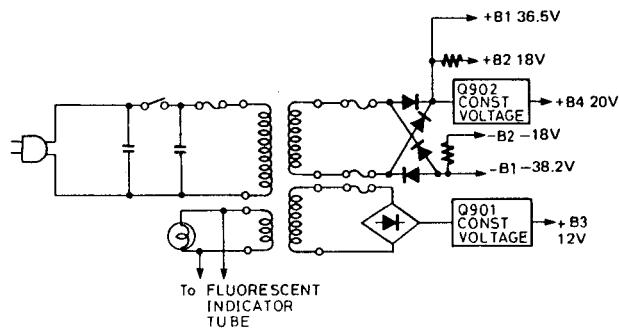


## BLOCK DIAGRAM

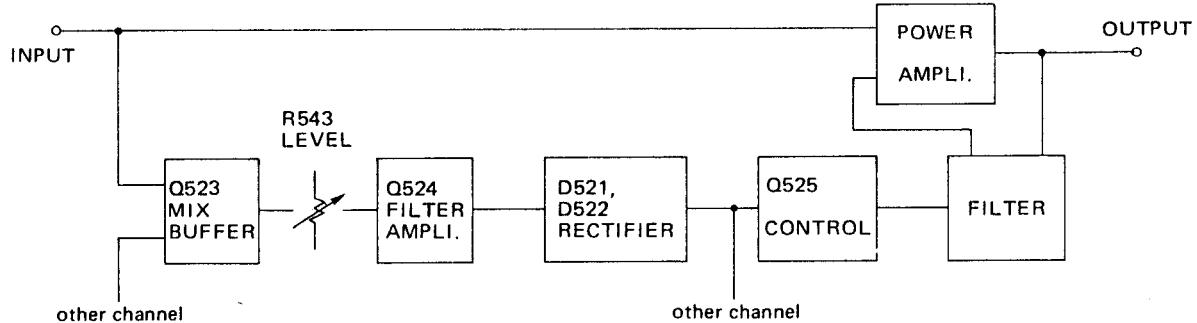
### -AMPLIFIER SECTION-



### -POWER SUPPLY SECTION-



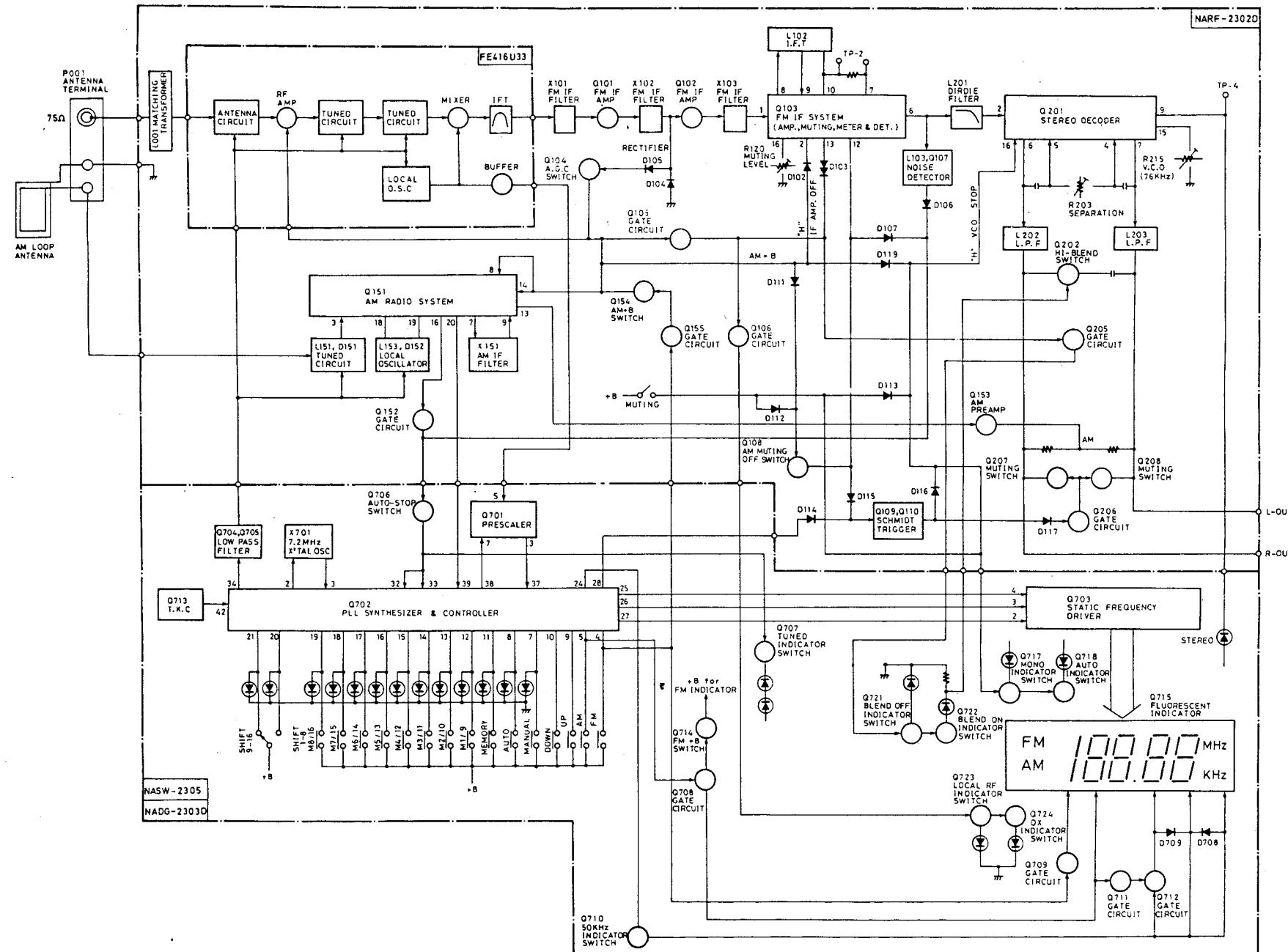
### -DYNAMIC BASS EXPANDER-



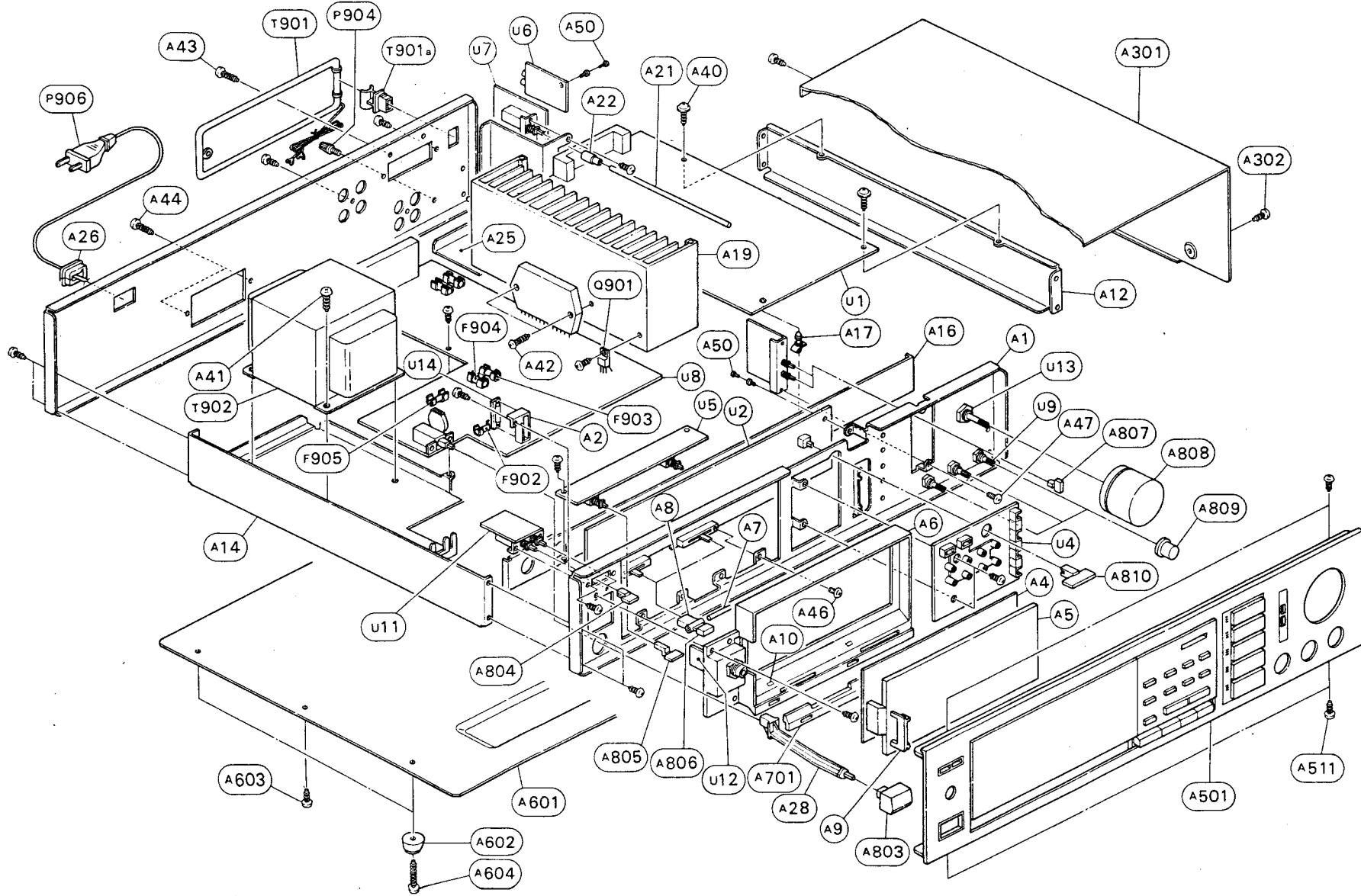
In earlier super base systems, only the frequencies about 70Hz were boosted by about 4dB to expand the playback frequency response to enable playback of the super low region. However, when there was no input signal, the above frequency response resulted in deterioration in the S/N ratio in the 70Hz region. This problem has been overcome by the dynamic bass expander where the 70Hz boosted level is varied according to the input signal level. That is, the frequency response remains flat when no input signal is applied, but is boosted at the 70Hz region to the specified level when the input signal exceeds a certain level. The left and right channel input signals from the INPUT terminals are mixed by Q523 and pass through the level volume and filter amplifier. The signal is rectified by D551 and D552, and the resultant DC component control signal is applied to the gate of Q525. When the input signal is at an adequate level, Q525 is turned on and the super base circuit of power amplifier is controlled by the input signal.

# BLOCK DIAGRAM

## -TUNER SECTION-



## **EXPLODED VIEW**



# PARTS LIST

| REF. NO. | PART NO.   | DESCRIPTION                 |
|----------|------------|-----------------------------|
| A1       | 27110243   | Front bracket               |
| A2       | 27190198A  | Holder, lamp                |
| A4       | 28133132A  | Back plate                  |
| A5       | 28130225B  | Dial plate                  |
| A6       | 27190358A  | Holder                      |
| A7       | 27260171B  | Shaft                       |
| A8       | 27220032A  | Slider                      |
| A9       | 27190359A  | Holder, dial                |
| A10      | 28198632   | Facet                       |
| A12      | 27115180   | Side bracket R              |
| A14      | 27130388   | Bracket, power transformer  |
| A16      | 27130390   | Bracket, center             |
| A17      | 27190011   | Holder                      |
| A19      | 27160174   | Radiator                    |
| A21      | 27260172   | Shaft                       |
| A22      | 28320135   | Connector                   |
| A24      | 27120684   | Back panel                  |
| A25      | 27130389B  | Bracket B                   |
| A26      | △ 27300750 | Strainrelief                |
| A28      | 27273030C  | Joint L                     |
| A30      | 27150202   | Shielded plate              |
| A38      | 834430068  | 3TTS+6B(BC), Tapping screw  |
| A40      | 831130088  | 3TTW+8B, Tapping screw      |
| A41      | 838440089  | 4TTB+8C(BC), Tapping screw  |
| A42      | 834430168  | 3TTS+16B(BC), Tapping screw |
| A44      | 834430108  | 3TTS+10B(BC), Tapping screw |
| A46      | 82142003   | 2P+3F(BC), Pan head screw   |
| A47      | 82143006   | 3P+6FN(BC), Pan head screw  |
| A50      | 880004     | Rivert                      |
| A301     | 28184271   | Top cover (S)               |
|          | 28184272   | Top cover (B)               |
| A302     | 834430068  | 3TTS+6B(BC), Tapping screw  |
| A501     | 18452121   | Front panel ass'y (S)       |
| A501a    | 27267387   | Guide, speaker              |
| A501b    | 27267386B  | Guide, power                |
| A501c    | 27267398   | Guide, loudness             |
| A501d    | 28191293B  | Clear plate                 |
| A501e    | 28321992A  | Selector knob ass'y         |
| A501f    | 28321998A  | Knob ass'y                  |
| A501     | 18472121   | Front panel ass'y (B)       |
| A501a    | 27267390   | Guide, speaker              |
| A501b    | 27267389B  | Guide, power                |
| A501c    | 27267399   | Guide, loudness             |
| A501d    | 28191295C  | Clear plate                 |

| REF. NO. | PART NO.  | DESCRIPTION                           |
|----------|-----------|---------------------------------------|
| A501e    | 28322012A | Selector knob ass'y                   |
| A501f    | 28322018A | Knob ass'y                            |
| A511     | 838430068 | 3TTB+6B(BC), Tapping screw            |
| A601     | 27170198A | Bottom board                          |
| A602     | 27175009A | Leg                                   |
| A603     | 834430068 | 3TTS+6B(BC), Tapping screw            |
| A604     | 834430128 | 3TTS+12B(BC), Tapping screw           |
| A701     | 27267402A | Guide, decoration                     |
| A803     | 28321928  | Knob, power (S)                       |
|          | 28321905B | Knob, power (B)                       |
| A804     | 28321886  | Knob, speaker (S)                     |
|          | 28321894  | Knob, speaker (B)                     |
| A805     | 28322005A | Knob, expander                        |
| A806     | 28322006  | Knob, slide                           |
| A807     | 28322007A | Knob, loudness (S)                    |
|          | 28322020A | Knob, loudness (B)                    |
| A808     | 28321887A | Knob, volume (S)                      |
|          | 28321895  | Knob, volume (B)                      |
| A809     | 28322008  | Knob, balance (S)                     |
|          | 28322021A | Knob, balance (B)                     |
| A810     | 28322009A | Knob, shift (S)                       |
|          | 28322022A | Knob, shift (B)                       |
| F501     | 252076    | 3.15A-SE-EAK, Speaker protection fuse |
| F601     | 252074    | 2A-SE-EAK, Primary fuse               |
| F902     | △ 252078  | 5A-SE-EAK, Secondary fuse             |
| F903     | △ 252074  | 5A-SE-EAK, Secondary fuse             |
| F904     | △ 252070  | 1A-SE-EAK, Secondary fuse             |
| F905     | 25060044  | Terminal GND                          |
| P904     | 253128 AS | AS-CEE, Power supply cord             |
| P906     | Q501      | 222041 STK-4843, Power amplifier IC   |
|          | Q901      | 222780122 78M12, Constant voltage IC  |
| T901     | 232085    | NMA-3034, AM loop antenna             |
| T901a    | 27190105  | Holder, antenna                       |
| T902     | △ 230870A | NPT-875G, Power transformer           |

## NOTE:

(S): Only silver model  
(B): Only black model

| REF. NO. | PART NO.  | DESCRIPTION   |
|----------|-----------|---|
| U1       | 18454502D | NARF-2302D, Tuner circuit pc board ass'y                    |
| U2       | 18454503D | NADG, 2303D, Digital circuit pc board ass'y                 |
| U4       | 18408505  | NASW-2305, Operation switch pc board ass'y                  |
| U5       | 18448506A | NAAF-2306A, Dynamic bass circuit pc board ass'y             |
| U6       | 18414507A | NAEQ-2307A, Equalizer amplifier pc board ass'y              |
| U7       | 18414508A | NASW-2308A, Source selector switch pc board ass'y           |
| U8       | 18454509D | NAAF-2309D, Power amplifier and power supply pc board ass'y |
| U9       | 18408510  | NATC-2310, Tone control circuit pc board ass'y              |
| U10      | 18448511A | NASW-2311A, Switch pc board ass'y                           |
| U11      | 18408512  | NASW-2312, Speaker switch pc board ass'y                    |
| U12      | 18408513  | NAHP-2313, Headphone terminal pc board ass'y                |
| U13      | 18408514  | NAVR-2314, Volume control pc board ass'y                    |
| U14      | 18414516  | NAPL-2316, Edge light pc board ass'y                        |

NOTE: THE COMPONENTS IDENTIFIED BY MARK △ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.

## CIRCUIT DESCRIPTIONS

### 1. Synthesizer and controller operation

| Pin No. | Symbol | Terminal                                    | Description  |
|---------|--------|---|--|
| 1       | GND    | Ground                                      |  |
| 2       | XT     | X'tal                                       | Connected to the 7.2MHz crystal oscillator for the reference frequency.  |
| 3       | XT     |   |  |
| 4       | FM     | FM band specification input                 |  |
| 5       | MW     | MW band specification input                 | Mutual reset type, performs switching of each band, FM/MW/LW.  |
| 6       | LW     | LW band specification input                 |  |
| 7       | MANUAL | Manual tuning mode specification input      | Mutual reset type, performs auto search and manual operation mode switching during UP/DOWN tuning.   |
| 8       | AUTO   | Auto search tuning mode specification input |  |
| 9       | UP     | UP tuning key input                         | Connect the push key and perform UP/DOWN tuning.   |
| 10      | DOWN   | DOWN tuning key input                       |  |
| 11      | STO    | Memory store command input                  | The preset memory is set to the write mode when the key is pressed.  |
| 12-19   | M1-M8  | Preset memory channel specification input   | Controls the write and read out of the internal 16-station preset memory along with the MC1 and MC2 input.   |
| 20      | MC-1   | Memory control input                        | Set the 16-station preset memory to the 8 FM/8 AM station mode or the FM/MW/LW 3-band 16-station random mode. The 8 FM/8 AM mode is used in this unit. |
| 21      | MC-2   |   |  |
| 22      | OSC2   | AM oscillator terminal                      | CR connection terminal for the oscillator that determines the scan speed during the AM search mode.  |
| 23      | OSC1   | FM oscillator terminal                      | CR connection terminal for the oscillator that determines the scan speed during the FM search mode.  |
| 24      | 0/5    | FM 50 kHz output                            | Output that represents the 50kHz FM band tuning step for European models. Goes to the high level for the 50 kHz setting.                               |
| 25      | CK2    | Tuned frequency data output                 | Outputs the serial data and timing clock to the tuned frequency display driver.  |
| 26      | CK1    |   |  |
| 27      | DATA   |   |  |
| 28      | MUTE   | Muting signal output                        | Goes to the high level during muting output.   |
| 29      | E2     | Regin specification input                   | See table 1.   |
| 30      | E1     |   |  |
| 31      | STOP 3 | AM IF signal input                          | During AM reception, this counts the IF signal and stops auto search.  |
| 32      | STOP 2 | Auto search stop signal input               | When the stop 1 input (pin 33) is at the high level and this terminal goes to the high level, auto search is stopped.                                  |
| 33      | STOP 1 | Scan speed slow input                       | When the high level is input at this terminal, the auto search speed is cut in half.   |

| Pin No. | Symbol          | Terminal                         | Description  |
|---------|-----------------|----------------------------------|--|
| 34      | D01             | Error output                     | Charge pump output of the phase detector which constitutes the PLL. High level is output when the divided oscillation frequency is high than the reference frequency. In the opposite case, low level is output. Floating occurs when the frequencies match. The output is applied to the variable capacitor diode in the front end through low pass filter Q704 and Q705. The output from both terminals is the same, but only D01 is used. |
| 35      | D02             |                                  |  |
| 36      | TEST            | Test terminal                    | Test mode at the high level.   |
| 37      | FM IN           | FM programmable counter input    | Connect to the prescaler output (Pin3 of Q701)   |
| 38      | PSC             | Pulse swallow control output     | Output to the control the division ratio of the prescaler.   |
| 39      | AM IN           | AM local oscillator signal input | Terminal for input of AM broadcast signal.   |
| 40      | INH             | Inhibit input                    | Operates normally at the high level. Inhibit status at the low level.  |
| 41      | INT             | Initialize input                 | Operates normally at the high level. At the low level, the internal status is initialized.   |
| 42      | V <sub>DD</sub> | Power supply                     | Device power terminal; supplies 5V during the normal operation and 2.5V from the super capacitor (C712) for memory preservation.   |

table 1.

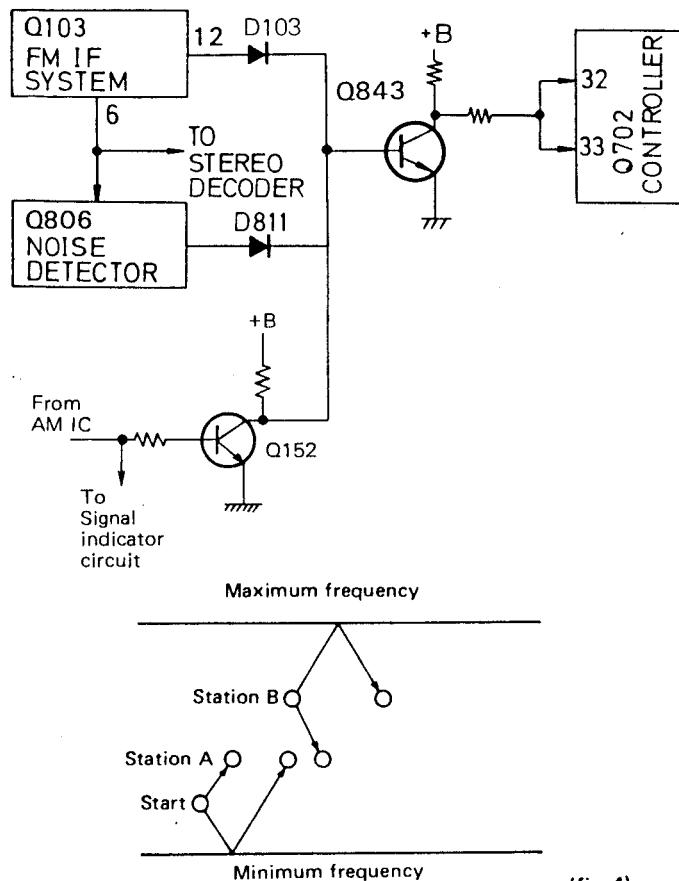
| E1<br>(Pin 30) | E2<br>(Pin 29) | Region | Band | Frequency range    | Intermediate frequency | Scan step | Reference frequency |
|----------------|----------------|--------|------|--------------------|------------------------|-----------|---------------------|
| 0              | 1              | U.S.A  | FM   | 87.5 ~ 108.0 MHz   | +10.7 MHz              | 100 kHz   | 25 kHz              |
|                |                |        | AM1  | 520 ~ 1710 kHz     | +450 kHz               | 10 kHz    | 10 kHz              |
|                |                |        | AM2  | 522 ~ 1710 kHz     | +450 kHz               | 9 kHz     | 9 kHz               |
| 1              | 0              | Europe | FM   | 87.50 ~ 108.00 MHz | +10.7 MHz              | 50 kHz    | 25 kHz              |
|                |                |        | MW   | 522 ~ 1611 kHz     | +450 kHz               | 9 kHz     | 9 kHz               |
|                |                |        | LM   | 153 ~ 360 kHz      | +450 kHz               | 1 kHz     | 1 kHz               |
| 0              | 0              | Japan  | FM   | 76.0 ~ 90.0 MHz    | -10.7 MHz              | 100 kHz   | 25 kHz              |
|                |                |        | AM   | 522 ~ 1611 kHz     | +450 kHz               | 9 kHz     | 9 kHz               |

## 2. Auto Hi-blend switch circuit

The Q103 FM IF system incorporates IC's with a built-in IF level detector with a 13 pin output.

If an input above 38dB enters the antenna, Q205 is turned on, and Q721 is turned on, the Q722 and Q202 are turned off and the high blend function is turned off.

### 3. Auto search tuning circuit



During FM reception, this is operated by the IF level detection and zero point detection circuits included in the FM IF system IC of Q103 and by the noise component detection circuit of Q806. When a station is tuned, the output of all outputs go to the low level so Q843 goes from on to off, causing pins 32 and 33 of the controller IC to go to the high level to complete auto search tuning.

During AM reception, this is operated by the IF level detection included in the AM radio system IC of Q151. When a station is turned, Q152 goes from off to on and Q706 goes to off, causing pins 32 and 33 of the controller IC to go to the high level to complete auto search tuning.

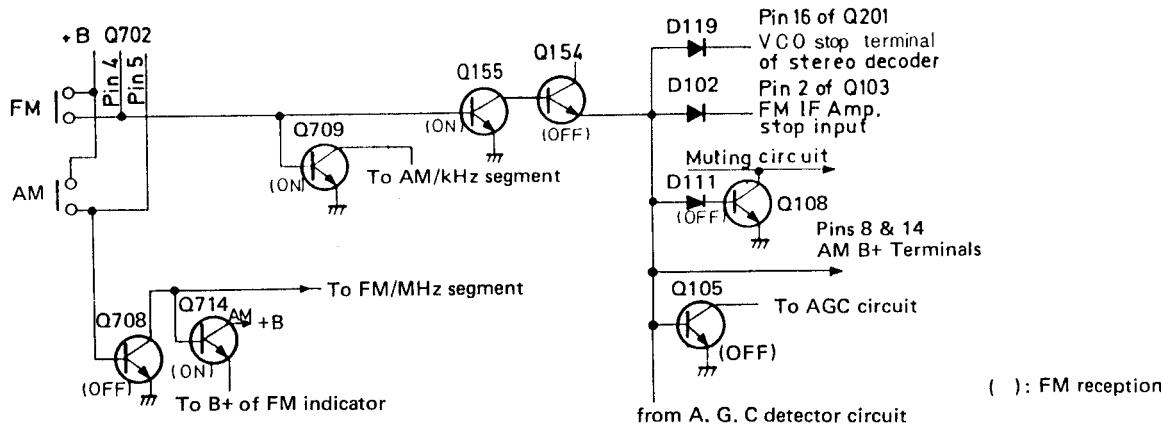
- **Manual Tuning**

When the UP or DOWN key is pressed, the frequency goes up or down by one step. When either key is held down, the frequency rapidly increases or decreases (scans) and stops when the key is released. When either end of the turning range is reached, key input will no longer be received and the frequency will stop at the highest or lowest frequency.

- **Auto Tuning**

When the UP or DOWN key is pressed, scanning begins in the up or down direction, stopping where there is a radio station. Since auto scan is operated by a triangular wave, scanning is begun in the opposite direction the instant either end of the tuning range is reached. Also, if the UP or DOWN key is pressed when the tuned frequency is not at either end of the range, up or down scanning will begin.

#### 4. FM/AM switch circuit

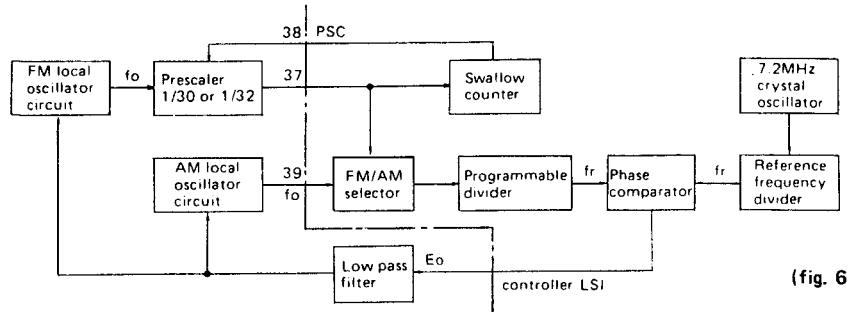


The FM/AM selector circuit is shown in the diagram, fig.5. Pins 4 and 5 of Q702 are of the mutual reset type. For FM, pin 4 is high and pin 5 is low; for AM, pin 4 is low and pin 5 is high. Because pin 5 is high and pin 4 is low during AM reception, Q709 is off, the AM, kHz segments of the fluorescent display are turned on. Also, since Q708 goes to on and Q714 is turned off, and the FM indicators are turned off. At the same time, Q155 is turned off and Q154 turned on, so +B is supplied to the power source terminal of the radio.

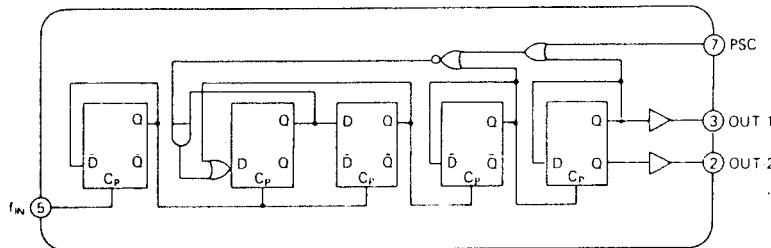
system pins 8 & 14 of Q151.

Pin 16 of Q201 goes to the high level, the VCO oscillator stops, and pin 2 of Q103 goes to the high level so the FM IF amp is also switched off. Also, during AM reception, Q108 is turned on so the muting circuit is off. During FM reception, all of the switching transistors mentioned above perform the opposite operations to switch to the FM mode. Figures in parenthesis indicate transistor operation during FM reception.

## 5. PLL tuned circuit



(fig. 6)



(fig 7) TD6104P (Prescaler)

A block diagram of the tuned circuit of the PLL is shown in figure 6.

### Operation during AM reception

The reception frequency is applied to the programmable divider where it is divided to  $1/N$  and output as  $f_v$ . This is applied to the phase comparator where it is compared with frequency reference  $f_r$  (9kHz for G/W model and 10kHz for D model). If  $f_r$  and  $f_v$  differ,  $E_o$  equal to the difference in frequency is output. Since error output  $E_o$  is a pulse waveform, it is passed through the low pass filter to change it into DC voltage  $V_D$ , which is applied to the variable capacitor diode in the front end to change the reception frequency. This continues until  $f_v$  and  $f_r$  are the same and  $E_o=0$ .

### Operation during FM reception

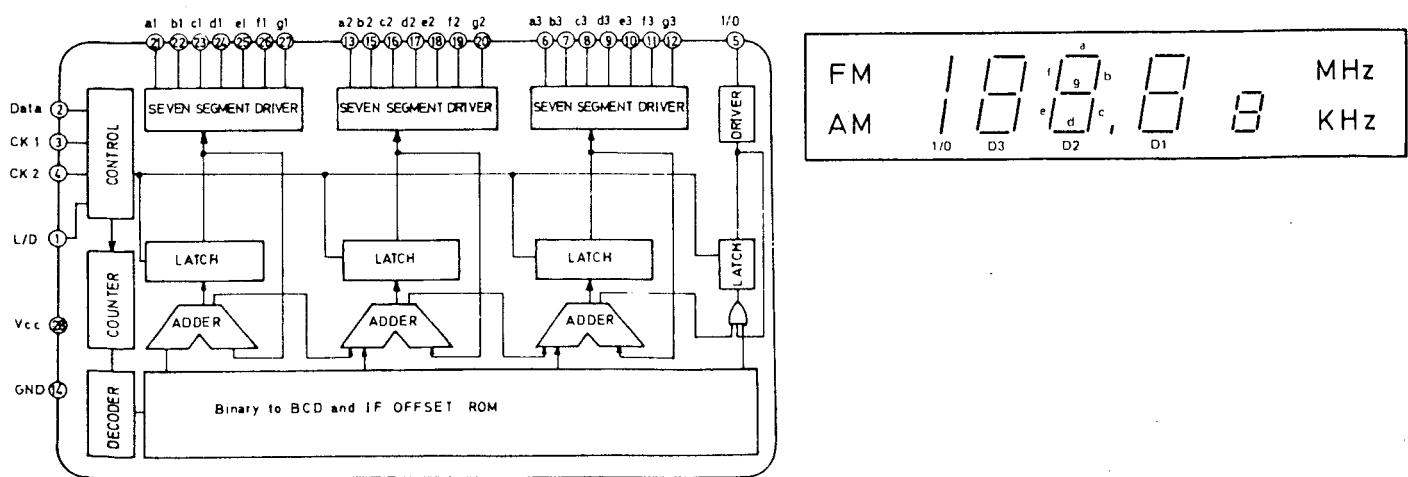
The pulse swallow method is used in the prescaler of this unit. In this type of prescaler, a supplementary number

(changed according to the program code input) and the divided reception frequency from the prescaler are combined in the control counter and the prescaler's division factor is switched 1/30 or 1/32 according to external control (1/32 when the PSC terminal is "H" and 1/30 when it is "L").

The station oscillator frequency is applied at the programmable divider, but the programmable divider has an upper frequency limit of only 30MHz, so the pulse swallow-type prescaler, which can be used up to 150 MHz, is inserted for division to  $1/N_p$ ;

The signal is applied to the programmable divider and divided to  $1/N$ . The result is compared with a 25kHz frequency reference in the phase detector and the error is output as  $E_0$  until a match is obtained as in AM operation.

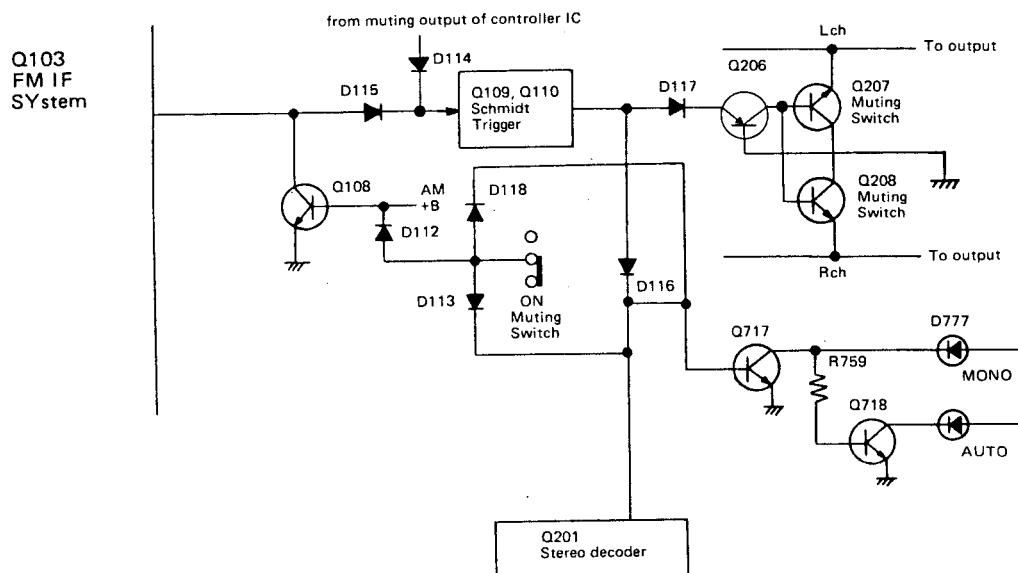
## 6. Frequency indicator circuit



(fig. 8) TD6301AP block diagram

| Pin No.   | Terminal | Description   |
|-----------|----------|---|
| 1         | L/D      | Output indication switching input terminal: Fluorescent display at the low level, and LED display at the high level.              |
| 2         | Data     | Tuned frequency data input terminal: Input from the system controller LSI to the serial.  |
| 3,4       | CK1, CK2 | Tuned frequency data input control timing input terminal:<br>Transferred simultaneously with data from the system controller LSI. |
| 5         | I/O      | Segment drive output terminal: Sets the number of display digit for FM (100MHz) and AM (1,000kHz) reception.                      |
| 6-12      | a3-g3    | Seven segment drive output terminals: Sets the number of display digit for FM(10MHz) and AM (100kHz) reception.                   |
| 13, 15-20 | a2-g2    | Seven segment drive output terminals: Sets the number of display digit for FM (1MHz) and AM (10kHz) reception                     |
| 21-27     | a1-g1    | Seven segment drive output terminals; set the number of display digit for FM (100kHz) and AM (1kHz) reception                     |
| 14        | Vcc      | Power source terminal   |
| 28        | Gnd      | Ground  |

## 7. Muting circuit



The muting circuit operates in the following cases.

1. While pin 28 of the controller IC outputs the high level, Q207 and Q208 are turned on and muting is closed in the following cases: (1) While the manual UP/DOWN switch is being held down, (2) When a station in the memory is recalled, and (3) While a radio station is being received using auto search tuning.
2. When an FM station is not being received (and the muting switch is on).

The IF level in the FM IF system (set at R120 so muting is opened at 17 dBf (low position)) and zero point detection circuit (tuning point 55kHz (100kHz step): 30kHz

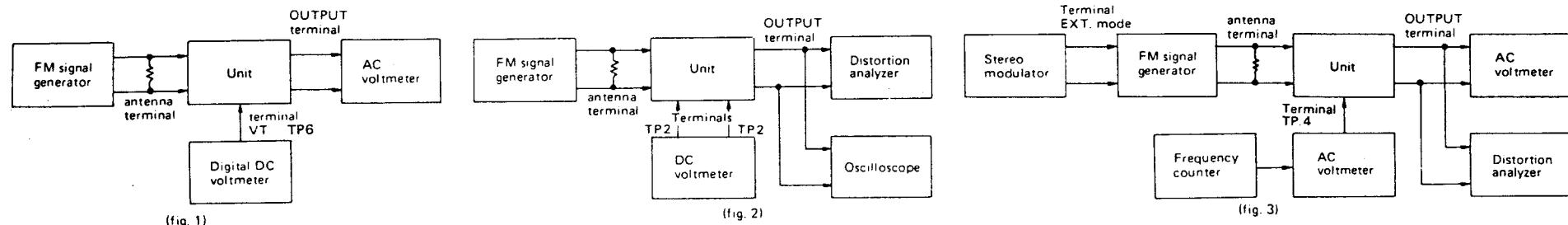
(50kHz step)— are output at pin 12 through the AND circuit. When a station is tuned, the output goes to the low level.

When output goes to the low level, Q109 is turned off, Q110 is turned on and Q207 and Q208 are turned off, so muting is opened. At the same, pin 16 of stereo decoder Q201 goes to the low level, so the VCO oscillator starts.

# ADJUSTMENT PROCEDURES

## FM section

| Item         | Step | Connection of instrument | FM SG output  | Stereo modulator output | Turning dial setting | Output indicator     | Adjustment          | Adjust for     | Remarks  |
|--------------|------|--------------------------|---|-------------------------|----------------------|----------------------|---------------------|----------------|--|
| FM RF        | 1    | Fig. 1                   | —   | —                       | 88.0 MHz             | Digital DC voltmeter | OSC                 | 1.4V           | Usually not necessary to adjust.   |
|              | 2    | Fig. 1                   | 107.9 MHz<br>1 kHz, 75 kHz devi.                    | —                       | 107.9 MHz            | AC voltmeter         | RF                  | Maximum output |  |
| FM IF        | 1    | Fig. 2                   | 99.0 MHz<br>1 kHz, 75 kHz devi.<br>65 dBf (60 dB)   | —                       | 99.0 MHz             | DC voltmeter         | L102 Primary coil   | 0V             | Muting switch : off<br>Repeat the steps 1 and 2 until no further adjustment is necessary |
|              | 2    | Fig. 2                   |   | —                       | 99.0 MHz             | Distortion analyzer  | L102 Secondary coil | Minimum        |  |
| VCO          |      | Fig. 3                   | 99.0 MHz<br>1 kHz, 75 kHz devi.<br>65 dBf (60 dB)   | —                       | 99.0 MHz             | Frequency counter    | R215                | 19 kHz ± 10 Hz | Muting switch: no  |
| Distortion   |      | Fig. 3                   | 99.0 MHz<br>65 dBf (60 dB)<br>Ext. modulation       | L+R 1 kHz               | 99.0 MHz             | Distortion analyzer  | IF                  | Minimum        |  |
| Separation   | 1    | Fig. 3                   | 99.0 MHz<br>65 dBf (60 dB)<br>Ext. modulation       | L ch. 1 kHz             | 99.0 MHz             | R ch. AC voltmeter   | R203                | Minimum        | Maximum and same separation  |
|              | 2    |                          |   | R ch. 1 kHz             |                      | L ch. AC voltmeter   |                     | Minimum        |  |
| Muting level | 1    | Fig. 2                   | 99.0 MHz<br>17.2 dBf (12 dB)<br>1 kHz, 75 kHz devi. | —                       | 99.0 MHz             | Oscilloscope         | R120                | Signal output  | Muting switch: on  |
|              | 2    |                          | 99.0 MHz<br>16.2 dBf (11 dB)<br>1 kHz, 75 kHz devi. |                         |                      |                      |                     | No output      |  |

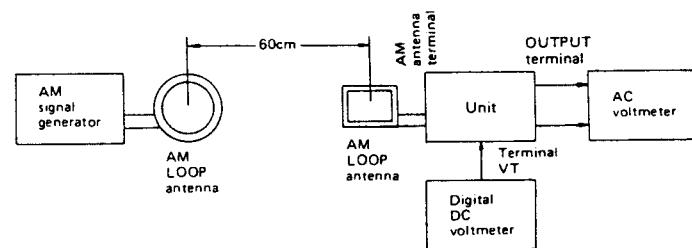


## AM section

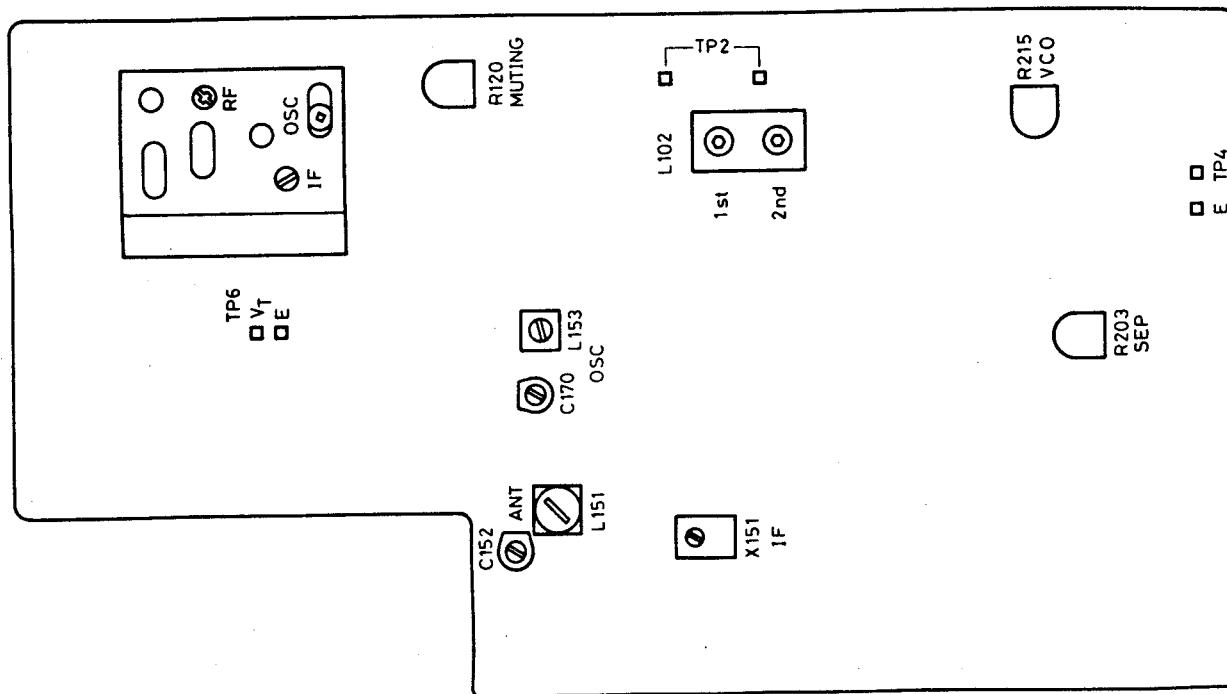
| Step | AM SG | Tuned | Output | Adjustment | Adjust for | Remarks |
|------|-------|-------|--------|------------|------------|---------|
|------|-------|-------|--------|------------|------------|---------|

## AM section

| Step | AM SG output                           | Tuned frequency | Output indicator     | Adjustment point | Adjust for | Remarks  |
|------|--|-----------------|----------------------|------------------|------------|--|
| 1    |  | 522kHz          | Digital DC voltmeter | L153             | 1.2V       | Repeat the steps 1 and 2 until no further adjustment is necessary. |
| 2    |  | 1611kHz         | Digital DC voltmeter | C170             | 9.0V       |  |
| 3    | 603kHz<br>(600kHz)<br>400Hz 30% mod.   | 603kHz          | AC voltmeter         | L151             | Maximum    | Repeat the steps 3 and 4 until no further adjustment is necessary. |
| 4    | 1404kHz<br>(1400kHz)<br>400Hz 30% mod. | 1404kHz         | AC voltmeter         | C152             | Maximum    |  |
| 5    | 999kHz<br>(1000kHz)<br>400Hz 30% mod.  | 999kHz          | AC voltmeter         | X151             | Maximum    |  |

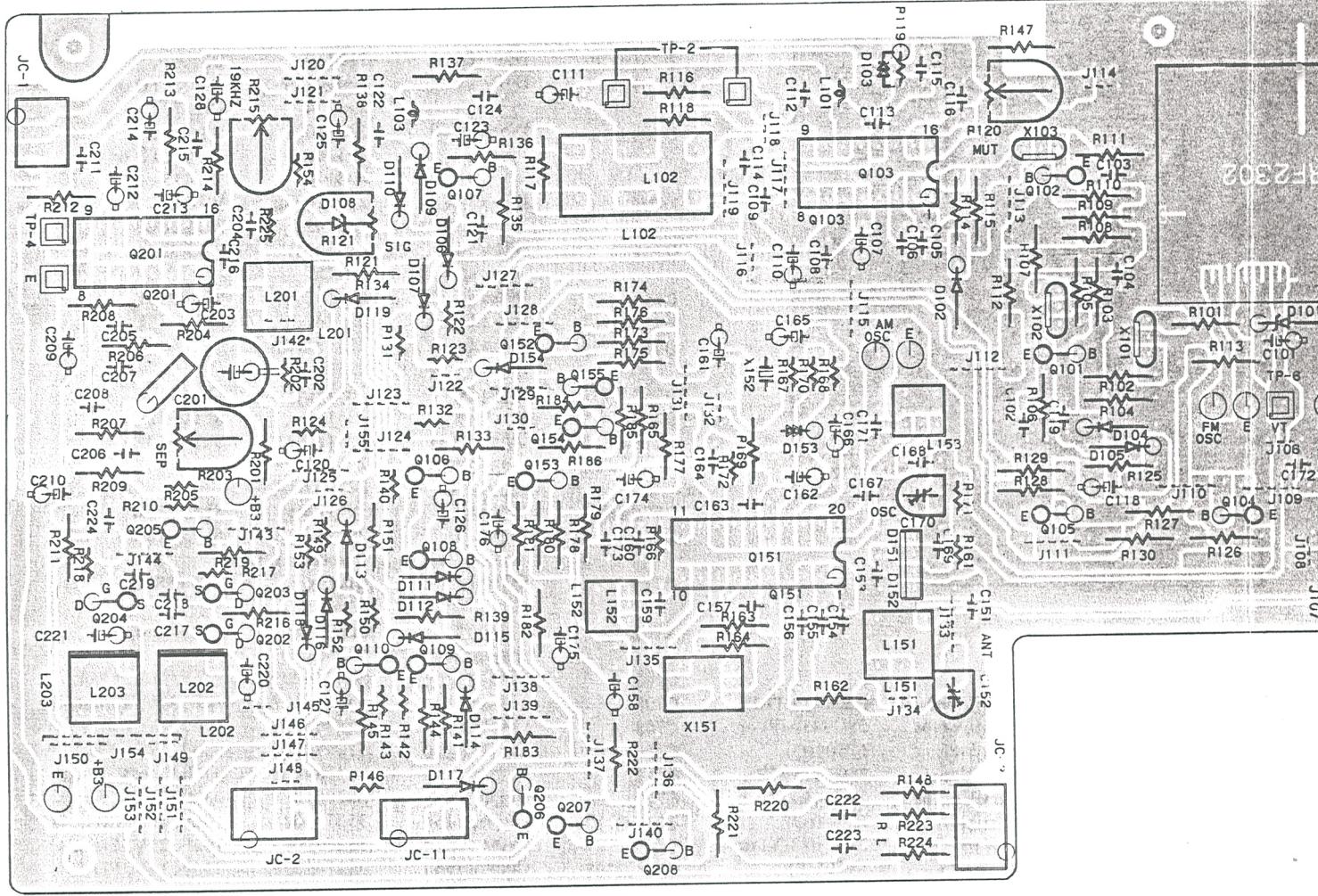


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## PRINTED CIRCUIT BOARD VIEW FROM BOTTOM SIDE

## TUNER CIRCUIT PC BOARD



# PRINTED CIRCUIT BOARD-PARTS LIST

## TUNER CIRCUIT PC BOARD(NARF-2302D)

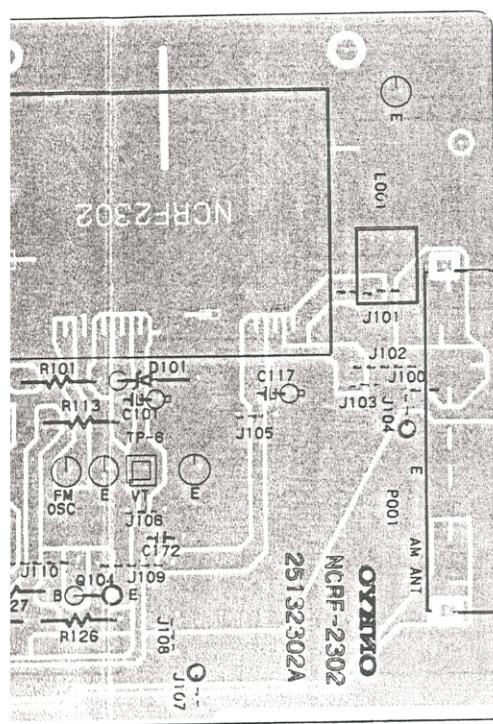
**CIRCUIT NO.**

**PART NO.**

### DESCRIPTION

**CIRCUIT NO.**

| CIRCUIT NO. | PART NO.                          | DESCRIPTION                               | Q206                   | Transistors                    |                                       | L153                 |
|-------------|-----------------------------------|---|------------------------|--------------------------------|---------------------------------------|----------------------|
|             |                                   |   |                        | Front end                      | 2SA1015(Y) or<br>JA101(P)             |                      |
| TU001       | 240059                            | FE416U33                                  | Q207,Q208              | 2211705 or<br>2211706          | 2SD655(E) or<br>2SD655(F)             | L201                 |
|             |                                   |   |                        |                                | <b>Diodes</b>                         | L202,L203            |
| Q103        | 222540                            | HA-11225                                  |                        |                                |                                       | L102                 |
| Q151        | 222701                            | LA-1245                                   | D101                   | 2243192 or<br>2239552          | MTZ8, 2B or<br>RD8, 2EB2              | X101-X103            |
| Q201        | 222678                            | μPC-1161C3                                |                        |                                |                                       | X151                 |
|             |                                   |   |                        |                                | <b>Transistors</b>                    | X152                 |
| Q101        | 2211723 or<br>2211722             | 2SC1923(O) or<br>2SC1923(R)               | D102,D106<br>D109-D119 | 223150,<br>223145 or<br>223124 | US1040,<br>1S2076TD or<br>1S2473      | C101                 |
| Q102        | 2211723 or<br>2211722             | 2SC1923(O) or<br>2SC1923(R)               | D108                   | 2243132 or<br>2239432          | MTZ4.7B or<br>RD4.7EB2                | C107,C110            |
| Q104,Q105   | 2211255,                          | 2SC1815(GR),                              | D104,D105              | 223132                         | 1K60                                  | C111                 |
| Q107-Q110   | 2210746 or                        | 2SC945A(P) or                             | D151,D152              | 223140                         | KV1236                                | C117                 |
| Q152        | 2212485                           | JC501(Q)                                  |                        |                                | <b>Coils</b>                          | C118                 |
| Q154,Q155   | 2211255,<br>2210746 or<br>2212485 | 2SC1815(GR),<br>2SC945A(P) or<br>JC501(Q) | L001<br>L101           | 233312<br>233105 or<br>233024  | NFA-3051<br>NCCH-1005 or<br>NCCH-1501 | C120<br>C123<br>C125 |
| Q153,Q106   | 2211256                           | 2SC1815(BL)                               | L103                   | 233031                         | NMC-9-1                               | C126                 |
| Q205        |                                   |   | L151                   | 232113                         | NMA-3049                              | C128                 |
| Q202        | 2211945 or<br>2212304             | 2SK246(GR) or<br>2SK381(D)                |                        |                                |                                       |                      |

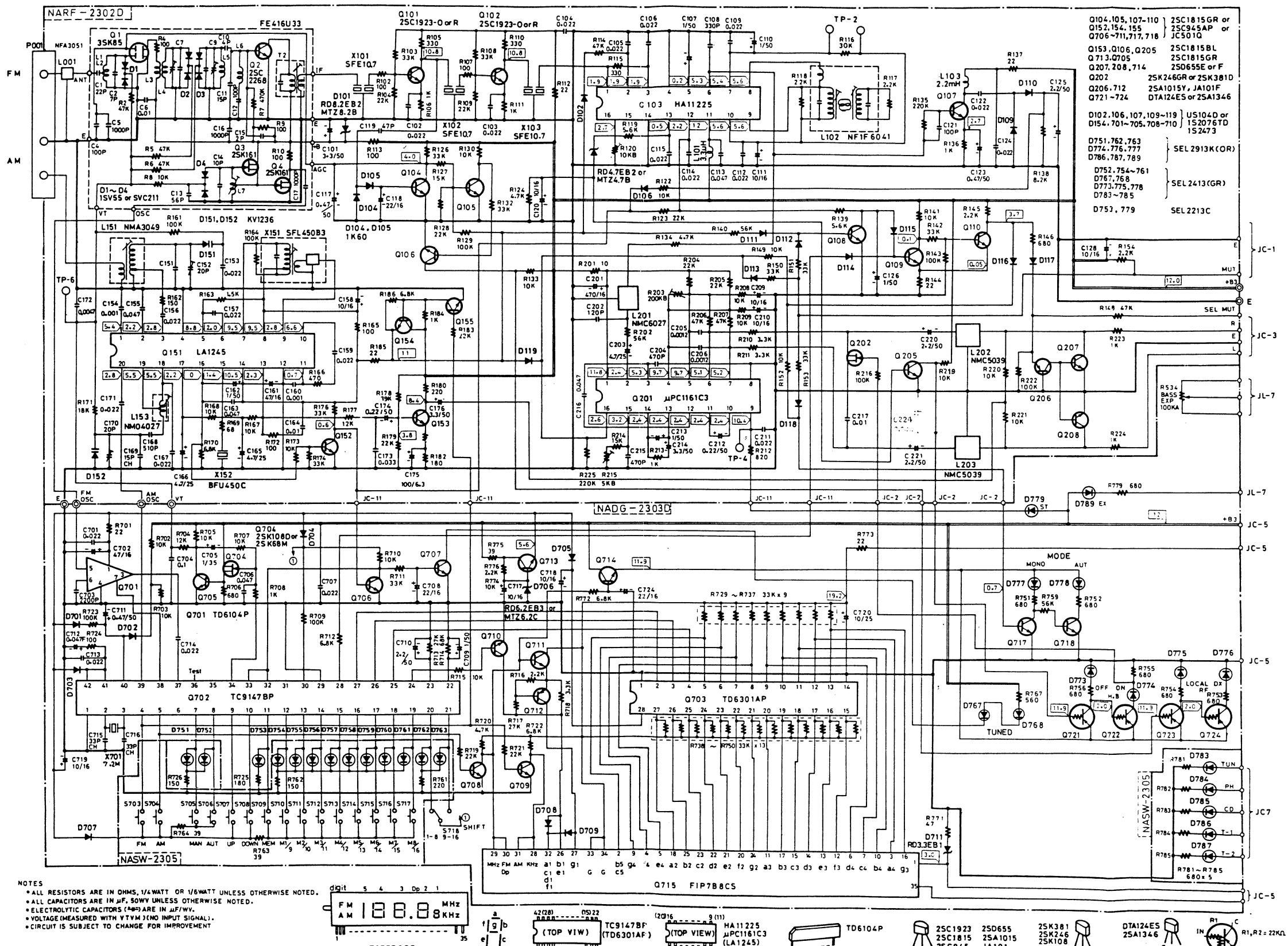


| CIRCUIT NO.       | PART NO.  | DESCRIPTION               |
|-------------------|-----------|---------------------------|
| <b>Capacitors</b> |           |                           |
| C152              | 3060010   | NTC-20P09, Trimmer        |
| C158              | 352741009 | 10 $\mu$ F, 16V, Elect.   |
| C161              | 352744709 | 47 $\mu$ F, 16V, Elect.   |
| C162              | 352780109 | 1 $\mu$ F, 50V, Elect.    |
| C165, C166        | 352750479 | 4.7 $\mu$ F, 25V, Elect.  |
| C168              | 370135114 | 510pF $\pm$ 5%, 100V, APS |
| C170              | 3060010   | NTC-20P09, Trimmer        |
| C174              | 352782299 | 0.22 $\mu$ F, 50V, Elect. |
| C175              | 352721019 | 100 $\mu$ F, 6.3V, Elect. |
| C176              | 352780339 | 3.3 $\mu$ F, 50V, Elect.  |
| C201              | 352744719 | 470 $\mu$ F, 16V, Elect.  |
| C203              | 352750479 | 4.7 $\mu$ F, 25V, Elect.  |
| C209, C210        | 352741009 | 10 $\mu$ F, 16V, Elect.   |
| C212              | 352782299 | 0.22 $\mu$ F, 50V, Elect. |
| C213              | 352780109 | 1 $\mu$ F, 50V, Elect.    |
| C214              | 352780339 | 3.3 $\mu$ F, 50V, Elect.  |
| C215              | 370134714 | 470pF $\pm$ 5%, 100V, APS |
| C220, C221        | 352780229 | 2.2 $\mu$ F, 50V, Elect.  |
| <b>Resistors</b>  |           |                           |
| R120              | 5215045   | N08HR10KBC, Semi-fixed    |
| R203              | 5215048   | N08HR200KBC, Semi-fixed   |
| R215              | 5215044   | N08HR5KBC, Semi-fixed     |
| <b>Terminal</b>   |           |                           |
| P001              | 25060087  | NTM-2PDMN31, Antenna      |
| <b>Sockets</b>    |           |                           |
|                   | 25050141  | NJPS-4P-S                 |
|                   | 25050140  | NJPS-3P-S                 |

| CIRCUIT NO.            | PART NO.  | DESCRIPTION               |
|------------------------|-----------|---------------------------|
| <b>Coils</b>           |           |                           |
| L153                   | 232110    | NMO-4027                  |
| L201                   | 233236    | NMC-6027                  |
| L202, L203             | 233291    | NMC-5039                  |
| <b>Transformer</b>     |           |                           |
| L102                   | 233274    | NFIF-6041                 |
| <b>Ceramic filters</b> |           |                           |
| X101-X103              | 3010043   | SFE10.7MM                 |
| X151                   | 3010075   | SFL450B3                  |
| X152                   | 3010076   | BFU450C                   |
| <b>Capacitors</b>      |           |                           |
| C101                   | 352780339 | 3.3 $\mu$ F, 50V, Elect.  |
| C107, C110             | 352780109 | 1 $\mu$ F, 50V, Elect.    |
| C111                   | 352741009 | 10 $\mu$ F, 16V, Elect.   |
| C117                   | 352784799 | 0.47 $\mu$ F, 50V, Elect. |
| C118                   | 352742209 | 22 $\mu$ F, 16V, Elect.   |
| C120                   | 352741009 | 10 $\mu$ F, 16V, Elect.   |
| C123                   | 352784799 | 0.47 $\mu$ F, 50V, Elect. |
| C125                   | 352780229 | 2.2 $\mu$ F, 50V, Elect.  |
| C126                   | 352780109 | 1 $\mu$ F, 50V, Elect.    |
| C128                   | 352741009 | 10 $\mu$ F, 16V, Elect.   |

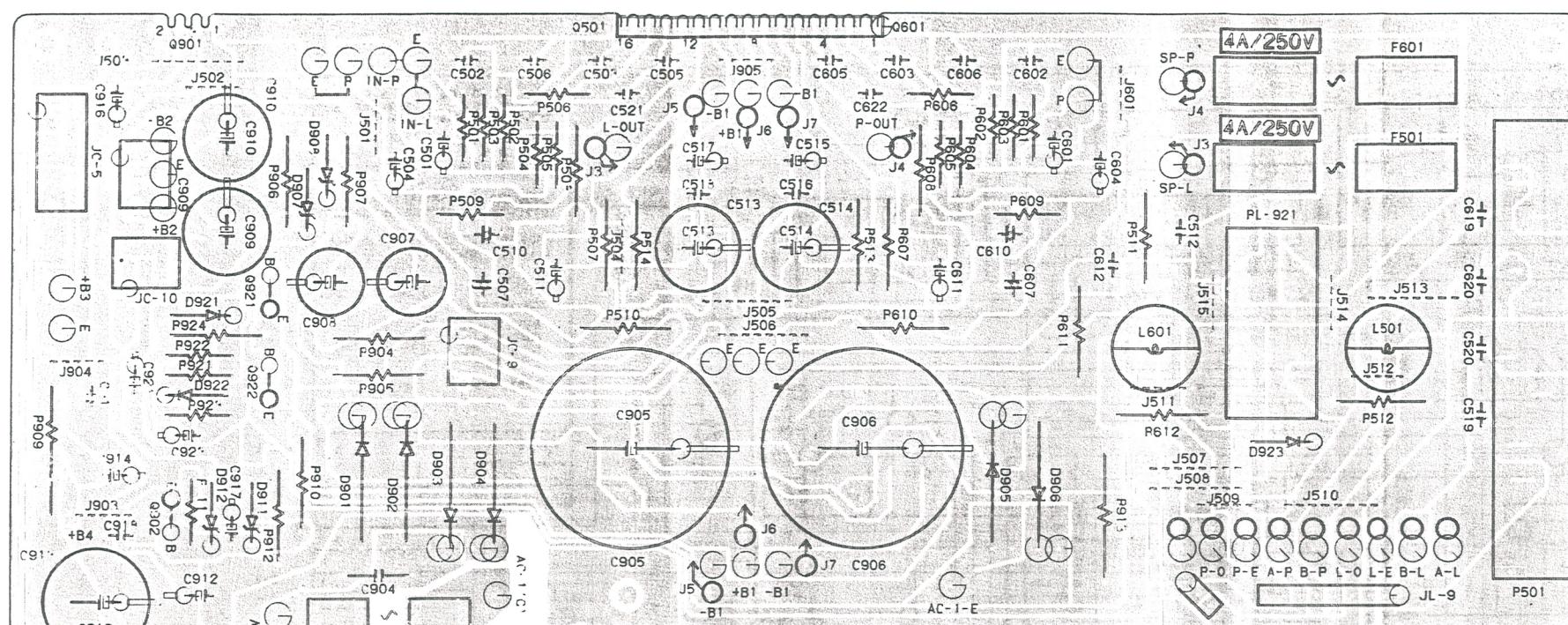
## SCHEMATIC DIAGRAM

## **-TUNER SECTION-**



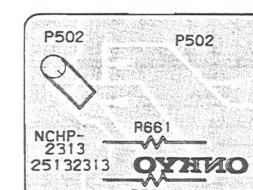
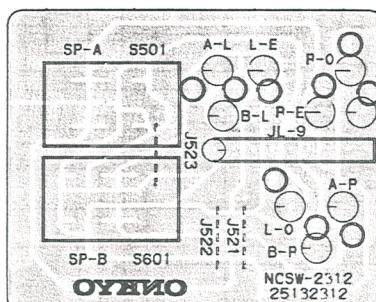
## PRINTED CIRCUIT BOARD VIEW FROM BOTTOM SIDE

POWER AMPLIFIER AND POWER SUPPLY CIRCUIT PC BOARD



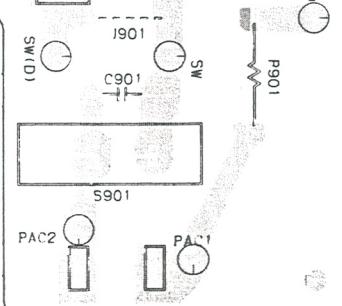
## SPEAKER SWITCH PC BOARD

## HEADPHONE TERMINAL PC BOARD



# PRINTED CIRCUIT BOARD-PARTS LIST

## POWER AMPLIFIER AND POWER SUPPLY PC BOARD (NAAF-2309A)



## POWER AMPLIFIER AND POWER SUPPLY (NAAF-2309A)

| POWER AMPLIFIER AND POWER SUPPLY PC BOARD<br>(NAAF-2309A) |                                    |                                 | CIRCUIT NO.                         | PART NO.                            | DESCRIPTION  |
|---|------------------------------------|---------------------------------|-------------------------------------|-------------------------------------|--|
| CIRCUIT NO.   | PART NO.                           | DESCRIPTION                     |                                     |                                     |  |
|   |                                    |                                 | D921-D923                           | <b>Diodes</b>                       |  |
|   |                                    |                                 |                                     | 223150,                             | US1040,  |
|   |                                    |                                 |                                     | 223145 or                           | 1S2076TD or  |
|   |                                    |                                 |                                     | 223124                              | 1S2473   |
|   |                                    |                                 |                                     | <b>Coils</b>                        |  |
| Q501,Q601   | 222041                             | STK-4843                        |                                     |                                     |  |
| Q901  | 222780122                          | 78M12                           | L501,L601                           | 231001                              | S-1.3B   |
|   |                                    |                                 |                                     | <b>Capacitors</b>                   |  |
| Q902,Q921   | 2211225                            | 2SC1815(GR)                     | C501,C601                           | 352780479                           | 4.7µF, 50V, Elect.   |
| Q922  | 2211254                            | 2SC1815(Y)                      | C504,C604                           | 352731019                           | 100µF, 10V, Elect.   |
|   |                                    |                                 |                                     | <b>Diodes</b>                       |  |
| D901-D906   | 223845                             | GP-20D                          | C510,C610                           | 352984799                           | 0.47µF, 50V, Non-polar elect.                                |
| D907,D908   | 2243273,<br>2241191,<br>2241192 or | MTZ18C,<br>GZA18X,<br>GZA18Y or | C511,C611<br>C513,C514<br>C515,C517 | 352784709<br>352781019<br>352781009 | 47µF, 50V, Elect.<br>100µF, 50V, Elect.<br>10µF, 50V, Elect. |
|   | 2239713                            | RD18EB3                         | C901                                | △3500065A                           | 0.01µF, AC400V/125V, IS                                      |
| D909  | 223862                             | WL01                            | C905,C906                           | 3504177                             | 6,800µF, 42V, Elect.   |
| D910  | 223880                             | GP101N4003                      | C907,C908                           | 352761019                           | 100µF, 35V, Elect.   |
| D911  | 2241291                            | RD3.3EB1                        | C909,C910                           | 352752219                           | 220µF, 25V, Elect.   |
| D912  | 2239733 or<br>2243283              | RD20EB3 or<br>MTZ20C            |                                     |                                     |  |

| CIRCUIT NO.        | PART NO.   | DESCRIPTION                            |
|--------------------|------------|--|
| <b>Capacitor</b>   |            |  |
| C912               | 352761019  | 100 $\mu$ F, 35V, Elect.               |
| C913               | 352752229  | 2,200 $\mu$ F, 25V, Elect.             |
| C914               | 352751019  | 100 $\mu$ F, 25V, Elect.               |
| C916               | 352741009  | 10 $\mu$ F, 16V, Elect.                |
| C917               | 352780109  | 1 $\mu$ F, 50V, Elect.                 |
| C921               | 352753309  | 33 $\mu$ F, 25V, Elect.                |
| C923               | 352780339  | 3.3 $\mu$ F, 50V, Elect.               |
| <b>Resistors</b>   |            |  |
| R507,R607          | 441521024  | 1k $\Omega$ , 1/2W, Metal oxide film   |
| R508,R608          | 441523324  | 3.3k $\Omega$ , 1/2W, Metal oxide film |
| R510,R610          | 441522424  | 2.4k $\Omega$ , 1/2W, Metal oxide film |
| R511,R611          | 441520474  | 4.7 $\Omega$ , 1/2W, Metal oxide film  |
| R512,R612          | 441520474  | 4.7 $\Omega$ , 1/2W, Metal oxide film  |
| R513               | 441525614  | 560 $\Omega$ , Metal oxide film        |
| R514               | 441521014  | 100 $\Omega$ , 1/2W, Metal oxide film  |
| R902               | 441523904  | 39 $\Omega$ , 1/2W, Metal oxide film   |
| R904-R907          | 441524314  | 430 $\Omega$ , 1/2W, Metal oxide film  |
| R908               | 441621024  | 1k $\Omega$ , 1W, Metal oxide film     |
| R909               | 441720624  | 6.2 $\Omega$ , 2W, Metal oxide film    |
| R910               | 441624714  | 470 $\Omega$ , 1/2W, Metal oxide film  |
| R924               | 441522704  | 27 $\Omega$ , 1/2W, Metal oxide film   |
| <b>Terminal</b>    |            |  |
| P501               | 25060058   | NTM-8PDML25, Speaker                   |
|                    | 25060092   | NTM-1S33                               |
| <b>Switch</b>      |            |  |
| S901               | △ 25035398 | NPS-111-L362P, Power                   |
| <b>Relay</b>       |            |  |
| RL921              | 25065134   | NRL-2P5A-DC24V-07                      |
| <b>Fuses</b>       |            |  |
| F501,F601          | △ 252076   | 3.15A-SE-EAK, Speaker protection       |
| F902               | △ 252074   | 2A-SE-EAK, Primary                     |
| F903,F904          | △ 252078   | 5A-SE-EAK, Secondary                   |
| F905               | △ 252070   | 1A-SE-EAK, Secondary                   |
| <b>Fuseholders</b> |            |  |
|                    | △ 25050065 | YSH403T                                |
| <b>Cover</b>       |            |  |
| C901a              | △ 27300601 | SB-1925, Capacitor for C901            |
| <b>Sockets</b>     |            |  |
|                    | 25050140   | NJPS-3P-S                              |
|                    | 25050143   | NJPS-6P-S                              |
| <b>Label</b>       |            |  |
|                    | 29360472   | T3 15A/250V, Fuse rating               |

## SPEAKER SWITCH PC BOARD(NASW-2312)

**CIRCUIT NO.**   **PART NO.**   **DESCRIPTION**  
S501 S601      25035467      NPS-212-L429, Speaker switch

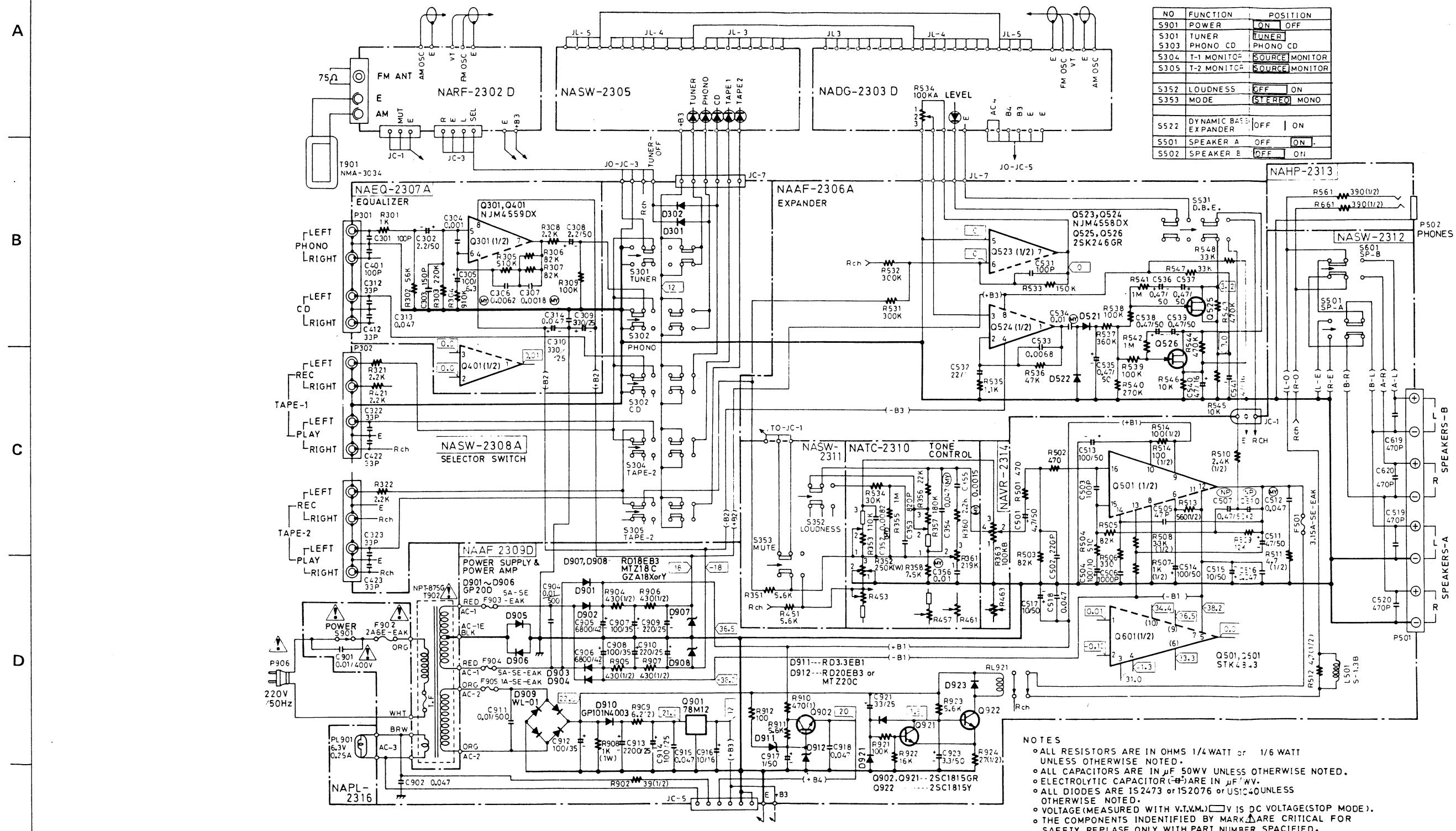
HEADPHONE TERMINAL PC BOARD(NAHP-2313)

| CIRCUIT NO. | PART NO.  | DESCRIPTION                           |
|-------------|-----------|---------------------------------------|
| P502        | 25045138  | HLJ0520-01-010, Headphone terminal    |
| R561,R661   | 441523914 | 390Ω, 1/2W, Metal oxide film resistor |

NOTE: THE COMPONENTS IDENTIFIED BY MARK  
△ ARE CRITICAL FOR RISK OF FIRE AND  
ELECTRIC SHOCK. REPLACE ONLY WITH  
PARTS NUMBER SPECIFIED

## **SCHEMATIC DIAGRAM**

## **-AMPLIFIER SECTION-**



NOTE

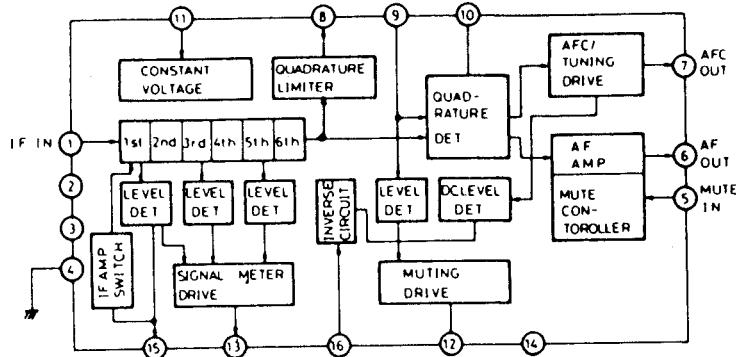
- ALL RESISTORS ARE IN OHMS 1/4 WATT or 1/6 WATT UNLESS OTHERWISE NOTED.
- ALL CAPACITORS ARE IN  $\mu$ F 50V UNLESS OTHERWISE NOTED.
- ELECTROLYTIC CAPACITOR (E) ARE IN  $\mu$ F 'WV.
- ALL DIODES ARE 1S2473 or 1S2076 or US1C40 UNLESS OTHERWISE NOTED.
- VOLTAGE (MEASURED WITH V.T.V.M.)  V IS DC VOLTAGE (STOP MODE).
- THE COMPONENTS IDENTIFIED BY MARK  ARE CRITICAL FOR SAFETY. REPLACE ONLY WITH PART NUMBER SPECIFIED.





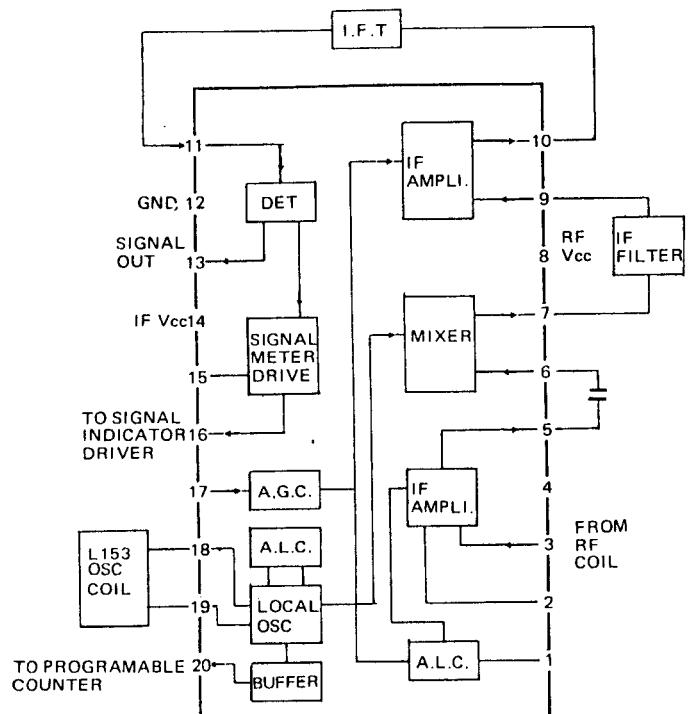
## **BLOCK DIAGRAM OF IC**

HA-11225(FM IF system)

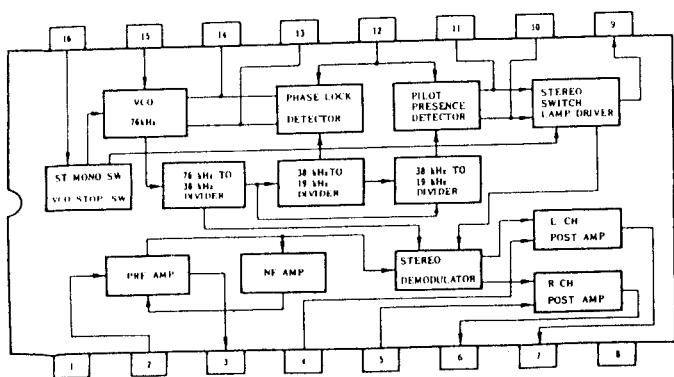


1. IF signal input
2. IF amplifier switch input  
H level: Off
5. Muting switch input
6. Composite signal output
7. AFC output
8. IF amplifier output
9. 10.7MHz input
10. Reference voltage
11. Power supply
12. Muting output  
Tuned: L level
13. Signal strength output
15. AGC output
16. Muting level

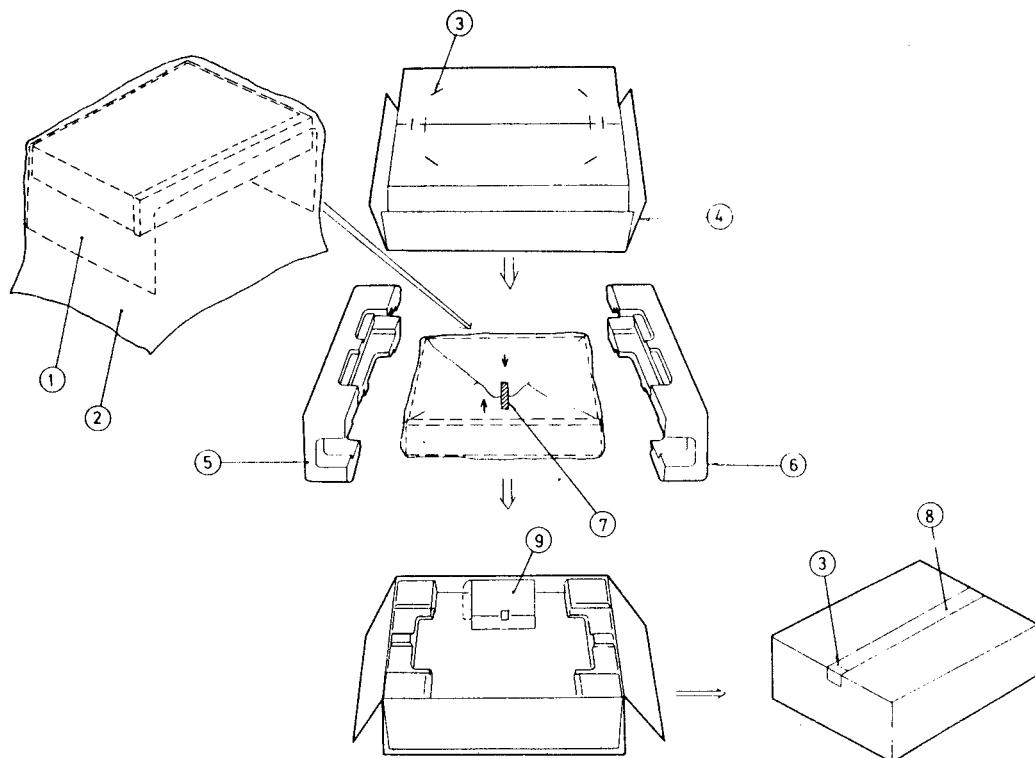
### LA-1245(AM radio system)



## **$\mu$ PC1161C3(Stereo decoder)**



## PACKING VIEW



| REF. NO. | PART NO.   | DESCRIPTION                     |
|----------|------------|---------------------------------|
| 1        | 29095012-1 | 500x800mm, Protection sheet (B) |
| 2        | 29100034   | 650x850mm, Poly-vinyl bag       |
| 3        | 282301     | Sealing hook                    |
| 4        | 29051094   | Master carton box (S)           |
|          | 29051095   | Master carton box (B)           |
| 5        | 29090817A  | Pad R                           |
| 6        | 29090816B  | Pad L                           |
| 7        | 29110032   | W=15mm, Adhesive tape           |
| 8        | 260012     | 50(W)x600mm, Damplon tape       |
| 9        | 292092     | Accessory bag complete          |
|          | 29100006.  | FM antenna                      |
|          | 29340864   | 350x250mm, Poly-vinyl bag       |
|          | 29365016   | Instruction manual              |
|          |            | Warranty card                   |

Note: (B): Only black model  
 (S): Only silver model